



Insight

2024 State of Spectrum

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Executive Summary

- New developments in both 5G networks and next-generation Wi-Fi require access to mid-band spectrum frequencies over which to operate, but currently most mid-band frequencies are controlled by federal agencies, particularly the Department of Defense.
- The lack of commercial mid-band spectrum could impact global harmonization of the U.S. spectrum management approach as the World Radio Conference recently embraced China's approach to allocating portions of the 6 GHz band for 5G; this development highlights that the U.S. approach - which has this band allocated to unlicensed technologies such as Wi-Fi and Bluetooth - may not be preferred internationally.
- Congress and the Biden Administration should work quickly to free up additional government-controlled spectrum in the lower mid-band for commercial use and embrace a balanced approach to spectrum policy to ensure all uses have the bandwidth necessary.

Introduction

As broadband providers and equipment manufacturers continue to develop and deploy next-generation wireless technologies, the need for additional radio spectrum — frequencies at which all radios operate — has never been greater. But as of [March 9, 2023](#), the Federal Communications Commission (FCC) lacked the authority to auction licenses for legal rights to operate radios at a specific frequency. Further, since the end of the last administration, the FCC hasn't allocated spectrum for unlicensed use, a categorization for equipment that doesn't need a spectrum license to operate, on which technologies such as Wi-Fi and Bluetooth rely. The United States is in a spectrum rut that federal regulators should

address.

In the meantime, international rivals haven't slowed down. Late last year, delegations at the World Radio Conference 2023 (WRC-23) [embraced a proposal largely pushed by China](#) to allow 5G services in the 6 GHz band, which the United States has already allocated for unlicensed use. This creates two separate but equally important problems. First, the United States will have less mid-band spectrum exclusively licensed for 5G services than countries that make this portion of the 6GHz available, meaning foreign adversaries such as China will lead in 5G and 6G development. Second, fewer countries will need equipment for unlicensed technologies in the 6 GHz band, meaning manufacturers will have less incentive to further develop and innovate unlicensed technologies in the band. This could leave the United States with fewer devices that operate in those bands.

Despite the need for more spectrum, federal agencies control most mid-band frequencies, and reallocating this spectrum requires significant coordination and cooperation. Experts have suggested that the United States should free up around [1500 MHz of additional government spectrum](#) for commercial use, a number that should allow all users the bandwidth needed. The National Spectrum Strategy (NSS) outlined a clear vision for achieving that goal, and there are numerous models for allocating spectrum in different bands, including full-power exclusive use licensing, unlicensed, and shared models that allow exclusive licenses and unlicensed underlays, each with their own costs and benefits. Nevertheless, it will take strong leadership from both the White House and Congress to allocate this spectrum.

This insight explains what spectrum is and the current allocations in the lower mid-band and the frequencies primarily at issue. It also discusses the importance of WRC-23 and what the conference has meant for the United States approach to spectrum policy. Finally, this insight outlines suggested paths forward, the logic behind them, and potential critiques.

Spectrum 101: What Are We Talking About?

Any wireless operation uses radio waves to send information over the air. Generally speaking, radio waves oscillate like any other wave, and the number of cycles a wave completes in a second is the frequency of that radio wave. Radio operators send information by manipulating radio waves, and the larger the range of frequencies available, the more data an operator can send. When using the term spectrum, most individuals are talking about the frequency ranges available for operation.

Why can't everyone get all the spectrum they need? Additional radio operations inherently add noise to the environment, making it more difficult for a receiver to pick up the desired

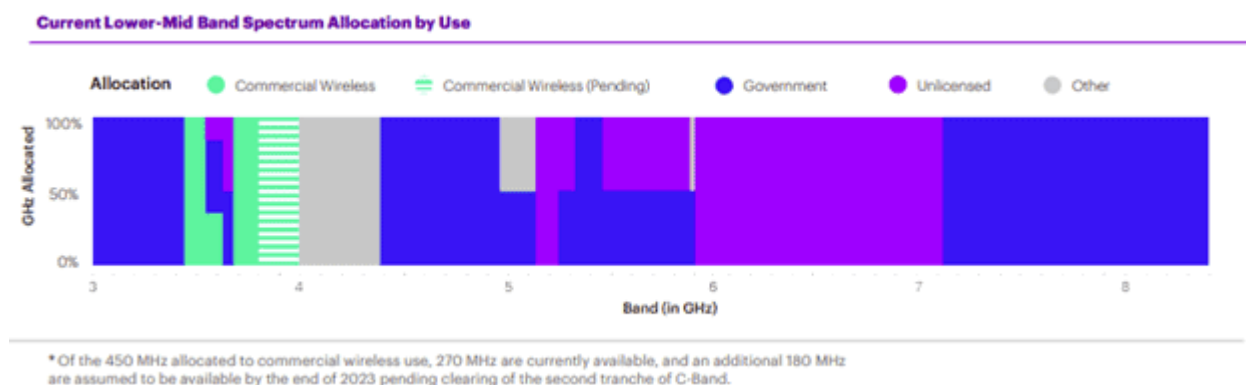
signal and filter out undesired ones. Harmful interference occurs when that noise deteriorates the functionality of the affected system. The key balance for spectrum regulators is to maximize bandwidth available to new uses while protecting incumbents from harmful interference.

Current Mid-band Landscape

Despite the ever-increasing bandwidth needs, the lower mid-band — the best balance between bandwidth and coverage range for next-generation wireless services — has primarily been allocated to federal users. Though definitions vary, the lower mid-band generally refers to 3 GHz to about 8.4 GHz, though some definitions go as low as 1 GHz.

While the federal government requires certain bandwidth to ensure important operations are protected, federal agencies control more than 60 percent of the available lower mid-band frequencies. Of these federal agencies, the Department of Defense (DOD) controls the most to operate systems such as radar defenses. Many of these systems and the studies regarding availability and ability to share, however, aren't disclosed fully to the public, making examination difficult.

The FCC employs three main models for allocating commercial spectrum: full-power exclusive use licensing (mainly used in mobile wireless networks), unlicensed (mainly used for technologies such as Wi-Fi and Bluetooth), and shared regimes that often place limits on operation but allow for more concurrent users. A visual representation of the current allocations from 3–8.4 GHz follows below.



Source: [Spectrum Allocation in the United States](#), Accenture (2022) (the pending designation is no longer pending).

Currently, 450 MHz of lower mid-band spectrum has been allocated to exclusive use, full-powered licenses (though additional spectrum from the 1–3 GHz range is in use in mobile

networks). As noted by the wireless trade association CTIA, this is roughly [seven times less spectrum](#) than is allocated to the federal government, and is about 200 MHz less than the average of other leading countries across the globe. Further, even in these bands, mobile wireless deployments have faced scrutiny from federal agencies, especially in the C-band where concerns from the [Federal Aviation Administration](#) regarding interference to altimeters delayed Verizon and AT&T deployments. These concerns have largely been resolved, but similar roadblocks could exist as future deployments proceed. At the same time, additional bandwidth is allocated for licensed use in the 1–3 GHz range, and while not specifically a focus of the wireless industry moving forward, this spectrum does share some similarities with the 3–8.4 GHz spectrum.

Around 1900 MHz has been allocated for unlicensed use. Unlicensed has long thrived in the mid-band because most unlicensed uses cover short distances. For example, a home Wi-Fi router doesn't need to cover an entire block, and paired with the lower power limits to prevent harmful interference, the 5 GHz band presented a perfect frequency band for improvements. Building on previous mid-band unlicensed allocations, the Trump Administration made portions of the 5.9 GHz band – previously allocated to vehicle safety technologies that weren't being used – and the entire 6 GHz band [available for unlicensed use](#). Around [80 percent of mobile traffic](#), for example, is now offloaded onto Wi-Fi, and the large bandwidth makes sense as home users more heavily rely on high bandwidth applications than on mobile devices. Wi-Fi traffic, however, continues to increase as many mobile users switch to home Wi-Fi when available, increasing the risk of harmful interference to other Wi-Fi users.

Finally, 150 MHz of lower mid-band spectrum has been allocated [to Citizens Broadband Radio Service \(CBRS\)](#). A unique model, the CBRS was design by the FCC as a shared regime to allow U.S. Navy radars to maintain priority but allow commercial use in areas unencumbered by Navy operations. The middle tier, known as priority access licenses, limits power levels below those of other exclusively licensed bands, and the licenses cover a smaller service area. CBRS also includes a general access tier, essentially unlicensed, for locations where neither the Navy nor a priority access user is operating. The band hasn't seen the most robust deployment, but it has been [picking up in recent years](#).

Global Wireless Leadership

While important for U.S. wireless businesses in their own right, robust commercial spectrum availability impacts how other nations decide to allocate bandwidth to different applications, and divergent approaches could lead to economic losses for U.S. firms.

For example, at the World Radio Conference 2023, delegations from across the world

largely adopted China's spectrum approach in the mid-band, allocating the upper part of the 6 GHz band for 5G services. As explained above, the United States has allocated all the 6 GHz band for unlicensed services, and the WRC designation does not force the United States to change course nor technically prevent other countries from adopting an unlicensed approach to the band. It does, however, internationally harmonize that [portion of the band for 5G services](#), basically meaning that countries don't have to allocate the band for 5G but can't allocate spectrum in a manner that would cause harmful interference to 5G operations in neighboring jurisdictions. As a result, equipment manufacturers will have less incentive, and potential profit, in designing and manufacturing additional unlicensed equipment that operates in the upper portion of the band, as fewer countries will allow the use of that technology.

The United States struggled to persuade countries to adopt its approach because it lacks a robust plan to commercialize spectrum in the mid-band for exclusive licenses, shared models, or even more unlicensed. Leading into the conference, the only mid-band spectrum teed up for commercialization was 3.1-3.45 GHz, and the DOD pushed back on efforts to allow commercialization of the band. Further, without auction authority, the United States lacked stability in spectrum policy, perhaps concerning potential allies that desired a robust plan for mid-band.

Moving forward, the United States will need to present a clear vision to drive international harmonization with its management plan. This will lead to economies of scale and first mover advantages. CTIA estimates that harmonization of mid-band spectrum could lead to [\\$200 billion in economic benefits](#), and on a global scale, Wi-Fi has added [trillions in economic value](#). The United States can lead in both of these technologies, but only if policymakers make more federal spectrum available for commercial use, encouraging international allies to follow suit.

Path Forward

To ensure the United States leads, experts [have suggested the FCC and National Telecommunications and Information Administration \(NTIA\)](#) make around 1500 MHz of lower mid-band spectrum for commercial use, which should provide enough bandwidth for all users. First, the NSS identified three bands that may be good candidates for either licensing, shared models, or unlicensed operations: 3.1-3.45 GHz, 5.03-5.091 GHz, and 7.125-8.4 GHz. All three bands are heavily encumbered by federal operations, however, and the FCC cannot simply reallocate the bands without agreement from the NTIA, which governs federal spectrum use. In addition, WRC also slated the 4.4-4.8 GHz band (as well as the 7.125-8.4 GHz band) for future study, potentially opening the door for international harmonization of commercial operations in the band. The NSS, however, [makes no spectrum](#)

available for commercial use, and study of the bands will take years. As a result, even if implementation goes smoothly, the United States will likely not allocate additional commercial spectrum in the next few years without congressional action. At the same time, the NSS was developed with cooperation from federal agencies, and without such buy-in any plans for reallocation may result in a prolonged fight between federal and non-federal interests.

Next, Congress should reauthorize the FCC spectrum auction authority. For any licensed allocation, whether for shared or exclusive use, spectrum auctions provide the optimal means of assigning operating rights. Yet previous attempts at reauthorization failed due to objections from DOD over the inclusion of a pipeline of bands designated specifically for auction. If Congress does not specifically mandate bands for auction, however, the FCC will likely lack the political sway to free up federally controlled spectrum. Further, specifically allocating bands for auction necessarily means that the frequency bands will be licensed and likely at full-power and exclusively used, sparking concerns about shared or unlicensed use of the band. If Congress does pass a reauthorization bill, it may need to allocate some of the bands outlined above specifically for auction, while also allowing other allocations to be decided by the FCC and the NTIA together. This could give the FCC the authority to determine the best model for the bands while also ensuring the bill can fund other congressional priorities. Finding the right balance, however, will be challenging as specifically designating bands for auction will limit potential unlicensed or shared operations, and such an approach could see strong pushback from federal agencies, further stalling out reallocation of spectrum.

Conclusion

The lack of commercial mid-band spectrum has jeopardized the United States' spectrum leadership. Congress and the Biden Administration should work quickly to free up additional government-controlled spectrum in the lower mid-band for commercial use and embrace a balanced approach to spectrum policy to ensure all uses have the bandwidth necessary.